Teaching Teachers

How to Succeed in Physics Without Really Crying

By Valarie L. Dickinson and Larry Flick

As a first-grade teacher, I enjoy watching my students learn as they explore and investigate. So I welcomed the chance to make my own discoveries in an introductory college-level course titled "Physics and Society." I soon learned, however, that there would be no hands-on learning or cooperative group participation in *this* class.

Using various coping strategies, I completed the physics course successfully. Nevertheless, I was relieved when the final class session came to an end. Overall, I had learned more about how to take a physics course than about physics itself. The instructors failed to make the role of physics in society clear and compelling to me. I was, however, able to reason through problems and conceptualize solutions by keeping a journal and talking to other students.

My journal was also helpful in pinpointing several valuable strategies that can help teachers master a science course. Asking myself, "How can teachers take science courses in a more positive and proactive manner?," I came up with a number of recommendations for both teachers and their instructors.

For the Elementary Teacher

Create a learning community. Tobias (1991) stated that lack of community is something that makes science hard. Whether learning physics or any other science subject, developing a community of learners is a good first step toward successful learning. Locate a colleague or form a group of peers with whom to share ideas and solve problems.

Don't dread solving problems. Problem-solving is a major focus in physics and in other science courses, but it needn't be something to dread. Realize that you may not be able to solve every problem in one sitting. It could take several days of thinking about a problem to visualize what is being asked and to understand the concepts required to work out a viable solution.

Think things through. Think about a problem in ways that work for you; writing or talking it out may help. Then, propose ways to solve the problem. Keep a record of your attempts at solutions so that you can refer to it as you proceed with this problem or approach other problems. Use your text as a reference book, and if you are having difficulty understanding it, find another source.

TEACHING TEACHERS presents practical teaching methods for preservice and inservice teachers. If you have an idea that you think could benefit your fellow teachers in their understanding of science and/or teaching, send your manuscripts to column editor Michael Kotar, Department of Education, California State University, Chico, CA 95929; e-mail mkotar@oavax.csuchico.edu.

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Keep a positive attitude. Talk to other students—you're not the only one struggling to understand the subject matter. If you have a hard time with certain concepts, don't take it personally. Concentrate on your motivations for taking the course. You are paying for the opportunity to learn, and you have the right to learn. Share your concerns with the instructor; he or she certainly wants to help you learn, but may not know how best to go about it. Often, working directly with the instructor will enable you to find better ways of learning and to arrive at greater understanding.

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To the College Instructor

Think about who your students are. Teaching non-science majors can be very different from teaching science majors. Find out your students' motivations for learning science. Although interested in learning, they may lack the background that you assume they have. Think about the objectives you have for your students. Decide what they need to know, and concentrate on those ideas. Present material at a pace that allows students to relate what they already know to the new ideas being presented. Give them time to assimilate this information before proceeding to the next idea.

Make your science course learner-friendly. Establish a learning environment where students feel comfortable taking risks, asking questions, and discussing ideas. Allow them to ask questions you might think are off the subject. Answer those questions, and probe further to see why they were asked. Are the questions related to the concept? Does the student see some kind of erroneous connection that you can help clear up?

Try a variety of instructional methods. If your students don't seem to be progressing, try instructional methods unlike your usual approach. Cooperative groups, for example, allow students to discuss ideas and solve problems together. Large-group discussion can help you assess student understanding and help students clarify their own conceptions. Try presenting concrete, visual examples of what you are explaining, or have students manipulate concrete materials to experience firsthand the concepts you are teaching. As another possibility, tape record a class discussion and listen carefully to glean insights into student thinking.

Employ alternative assessment. Consider alternative means of assessing your students' knowledge. For example, you could assign fewer problems over a longer period of time and require a written explanation of student reasoning. This approach will enable your students to explore an idea in depth. It will also give you more time to provide sufficient feedback to help the students understand the science involved in solving the problem. Contemplate using written work, oral explanations, portfolios, and journals to determine your students' progress.

An Open Door

It is important to keep the door to science open for elementary teachers. Introductory college science courses can and need to be invitations to teachers and others to take more science (Tobias, 1985). Teachers need to be excited and intrigued by what they are learning so that they can inspire their own students to enjoy, learn, and respect science.

Establish a learning environment where students feel comfortable asking questions.

If elementary teachers and college instructors can work together in a positive way, then the teachers' knowledge, enthusiasm, and positive attitude will be passed on to the young students in their charge, and the quality of science education will be improved at every level.

Resources

Tobias, S. (1985). Math anxiety and physics: Some thoughts on learning 'difficult' subjects. *Physics Today, 38*(6), 61-68.

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____. (1991). What makes science hard. *American Journal of Pharmaceutical Education, 55,* 378–382.